9.7.1.5 DESIGN OF CANTILEVER SLABS

STANDARD CONCRETE PARAPET

Bridge Section policy for the reinforcement of deck overhangs that support ITD standard concrete parapet shall be the reinforcement for the empirical deck design requirements for the top mat (#5 rebar at 12") with the addition of #6 rebar spaced between the standard #5 bars. This shall be considered adequate for those areas at least 8 feet from any joint or discontinuity in the parapet. For areas less than 8 feet from joints or discontinuities in the parapet two #6 bars shall be evenly spaced between the #5 bars. The length of the additional #6 rebar shall be such that the bar extends at least halfway between the exterior girder and the first interior girder. This policy only applies to 8 inch minimum thick decks with a minimum overhang of 24 inches from the centerline of the exterior girder to a maximum overhang of 72 inches.

STANDARD CONCRETE RAIL MOUNTED ON WALLS, CURBS OR EDGE BEAMS

For the design of retaining walls and curbs or edge beams supporting standard concrete parapet the following design procedure may be used (also applicable for decks supporting curbs or edge beams where parapets are constructed on the curb or edge beam, i.e. buried decks):

For walls and curbs only design Case 1 of Article A13.4.1, extreme event limit state, need be considered. The design loads are specified in Table A13.2-1. Design Case 3 need only be considered for the design of decks that support curb or edge beams with parapets. The loads for Design Case 3 shall be in accordance with Article 3.6.1, strength limit state.

Design Case 1 Loads for Traffic Railings.

F_t = 54 kips (from table A13.2-1 for TL-4)

For the general case, at least 8 feet from parapet joints or discontinuities, the design loads may be distributed over a length of wall, curb or deck as follows:

$E_m = 11 + 2.67x$
$E_t = 6 + 2.67x$ (for horizontal members only)

For the ends of parapet sections within 8 feet of joints or discontinuities the design loads may be distributed over a length of wall, curb or deck as follows:

$E_m = 7.5 + 0.5x$
$E_t = 10 + 4x$ (for horizontal members only)

where: E_m = the length of wall, curb or deck the design moment is distributed over in feet.
E_t = the length of deck the design tension force is distributed over in feet.
x = the distance from the base of rail to the design location in feet, either vertical or horizontal or both.

In any case the load distribution length shall not exceed the actual member length.

In lieu of the above method the provisions of Article A13.4.2 may be used where applicable.

Commentary

The above distribution equations where derived from the results of an elastic finite element analysis using the LARSA structural analysis program. These equations are based on the resulting tension and bending moment in the most severely stressed 6" width of the supporting member. If these equations are directly applied to the case of a parapet supported on a standard 8" thick deck overhang the calculated area of reinforcement at the face of rail would be 0.76 in^2/ft, while a #5 and #6 bar at 12 inch spacing equals 0.75 in^2/ft. This is considered acceptable, however, because the LARSA model conservatively assumes an elastic distribution while the extreme event limit state relies on the ultimate strength of the supporting deck, which cannot be realized without significant yielding of the reinforcement (the strain at ultimate in this case is 580% of the yield strain), thereby resulting in a greater width of load distribution.

Revisions:

June 2013	Article was renumbered from A13.4.1
Mar 2015	Revised article for change to #5 top mat reinforcement for the empirical design.